REMARKS/ARGUMENTS

STATUS OF CLAIMS

In response to the Office Action dated January 11, 2007, claims 1 and 3-11 have been amended, and claim 2 has been canceled. Claims 1 and 3-11 are now pending in this application. No new matter has been added.

REJECTION OF CLAIMS UNDER 35 U.S.C. § 112, SECOND PARAGRAPH

Claims 1-11 have been rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. The Examiner maintains that "multi-nuclear metal molecule" is not clear and takes this to mean "a cluster of metal molecules".

By this response, claims 1 and 3-11 have been amended to change "multi-nuclear metal molecule" to "metal cluster complex". This change is supported by the description at page 20, line 24 to page 21, line 2 of the present application.

Claims 1 and 3-11, as amended, are believed to recite the invention with the degree of precision and particularity required by the statute. Therefore, it is respectfully urged that the rejection be withdrawn.

REJECTION OF CLAIMS UNDER 35 U.S.C. § 102 AND § 103

I. Claims 1-3 and 5-7 have been rejected under 35 U.S.C. § 102(e) as being anticipated by Yamashita (US 2002/0029746).

Claims 1-3 and 5-7 have been rejected under 35 U.S.C. § 102(e) as being anticipated by Horsky et al. (USPN 7,107,929).

Claims 1-3 and 5-8 have been rejected under 35 U.S.C. § 102(e) as being anticipated by Watababe et al. (US 2002/0132063).

Claims 1, 2, 4, 8 and 9 have been rejected under 35 U.S.C. § 102(e) as being anticipated by Cadieu (USPN 6,805,916.).

Claim 4 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over Yamashita in view of Mizutani et al. (USPN 5,284,544).

Claim 10 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over Yamashita in view of Mizutani et al., and further in view of Vaartstra (USPN 6,402,126).

Claim 11 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over Morimoto et al. (USPN 4,559,901) in view of Dykstra (US 2002/162508).

II. To expedite prosecution, independent claim 1 has been amended to recite:

> A molecule beam apparatus, which generates an ion beam by using a metal cluster complex, wherein
> the metal cluster complex is vaporized or atomized, and
> the metal cluster complex that is vaporized or atomized is ionized.

In addition, independent claim 11 has been amended to recite:

> A molecular beam apparatus, comprising:
> vaporization means for vaporizing or atomizing a metal cluster complex;
> ionization means for ionizing the vaporized or atomized metal cluster complex;
> acceleration means for accelerating the ionized metal cluster complex;
> convergence means for converging an orbit of a beam of the metal cluster complex accelerated, by making the orbit to be curved; and

scanning means for scanning with the beam of the metal cluster complex accelerated and converged, toward a substrate, by making the orbit of the beam to be curved.

III. One of the features of the inventions recited in amended claims 1 and 11 resides in that a metal cluster complex, which is a chemically stable compound, is utilized for a cluster beam source. That is, the above feature of the inventions recited in amended claims 1 and 11 is that the beam source is already a cluster, but not a cluster that is formed in a gas phase.

A cluster ion beam is useful. However, although it is necessary to control the cluster ion beam to have a given cluster size, such control has been difficult with conventional techniques. With the inventions recited in amended claims 1 and 11, contrary to the conventional techniques, it is possible to obtain a cluster beam formed by the metal cluster complex molecules uniform in the cluster complex size, by using, as a raw material of the beam, a chemically stable ***metal cluster complex***, which already has cluster structure in its solid state and can provide a sample (gas) uniform in cluster complex size of the resulting cluster complexes.

The above is one of the features of the inventions recited in amended claims 1 and 11, and how to conduct ionization is a matter of elemental technique to carry out the inventions.

Generally, a cluster beam is intended to utilize a function as a plurality of clusters of atoms. This function is predominantly governed by cluster complex size in a molecular beam to be emitted. Thus, if the cluster complex has a distribution of cluster complex size, it hinders utilization of the cluster beam. Further, distribution of cluster complex size is based on the difference of mass number of clusters contained therein. However, it is difficult to converge a beam that has such distribution of cluster complex size. This hinders the utilization of the cluster beam.

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To solve the above-mentioned problems with conventional techniques, one of the features of the inventions recited in amended claims 1 and 11 is that a chemically stable metal cluster complex, which is solid, is to be used as a source to generate the cluster.

As explained above, when a metal cluster complex is utilized as a source for generating a molecular beam, i.e. a cluster ion beam (see page 21 in lines 10 to 11 of the present application), the metal cluster complex is released from the solid into a gas phase, while the unit structure of such a complex molecule is maintained. This is because the metal cluster complex molecule is chemically stable. As a result of this phenomenon, the resulting cluster complex size in the gas phase has no distribution (see the left-hand figure on the attached Document 1).

This attached Document 1 has been prepared by Mr. Fujimoto, one of the Applicants. Applicants believe that it may be possible that the Examiner does clearly appreciate an important and patentable feature of the inventions recited in amended claims 1 and 11 due to the fact that a metal cluster complex is not generally known as an example of multi-nuclear metal molecules. It is believed that the attached document will be a helpful aid to the Examiner to recognize that the technical idea of the inventions recited in amended claims 1 and 11 clearly differs from that in conventional techniques, and that the subject matter recited in amended claims 1 and 11 is not obvious to one of ordinary skill in the art in view of the applied prior art references.

Applicants submit that none of the applied prior art references cited by the Examiner discloses or suggest above-mentioned utilization of a metal cluster complex as a cluster beam source. In this regard, it should be noted that Yamashita (US 2002/0029746) uses indium

fluoride (6a in Fig. 1, paragraph **[0039]**), Horsky et al. (USPN 7,107,929) uses decaborane (19, FIG. 3, col. 23, line 25), Watanabe et al. (US 2002/0132063) uses a film material (9) for optical filter for optical communications or WDM (paragraphs **[0015]**, **[0029]**, **[0050]**); Morimoto et al. (USPN 4,559,901) uses MgF_2, ZnO, Si, Au, Ag, GaAs, BeO, GaP (col. 9, lines 48-53); and Dykstra (US 2002/162508) uses source 114 gases of Ar, inert gases, O_2, N_2, oxygen-bearing gases (e.g. CO_2), nitrogen-bearing gases, halogens, halogen-bearing gases (Fig. 1, paragraphs **[0005]**, **[0007]**). Furthermore, Cadieu (USPN 6,805,916) describes high quality thin films (col. 1, line 59), Mizutani et al. (USPN 5,284,544) describes radical supply source other than plasma, Vaartstra (USPN 6,402,126) describes atomization for use in CVD.

When energy is given, for example, to metal solid, such as aluminum, by heating or in another manner, atoms in part constituting the metal cannot stay in the solid state and are released into a gas phase. As a form of that releasing, a cluster (or polymer) associated with a plurality of the atoms, as well as an atom per se are mentioned. An atom/cluster ratio and/or a cluster size distribution may vary by changing the kind or composition of atom(s) constituting the metal or the method of applying energy. Further, there have been attempts to control cluster size by controlling the pressure of a gas phase or the kind of co-existent gas. However, cluster size distribution has generally a wide distribution, e.g. 100 to 1,000 atoms/cluster-molecule (see the right-hand figure on the attached Document 1).

Further, it is also possible to form clusters, using collision and association of atoms or cluster in a gas phase, with adiabatic expansion or the like. However, in such case, the sizes of the resultant clusters have a wide distribution. Please note that even if ionic reaction at a gas phase is used, it is difficult to form a single species of cluster that is uniform in size.

In addition, in these methods, there is a problem that formation of the cluster is governed by probability, tends to be affected by the influence of outer disturbances and it is difficult to form the cluster stably.

As discussed above, cluster formation with conventional techniques is typically due to heating/adiabatic expanding of metal aluminum or the like, but not due to using any complex. In addition, the thus-obtained aluminum cluster has a wide distribution of the size. Therefore, even if a cluster formed by this method were used, **NO** ***beam uniform in a cluster molecule size can be obtained.***

Comparison between the present invention and the cited references

As discussed above, the inventions recited in amended claims 1 and 11 have a solid metal cluster complex as a cluster source. Therefore, it is possible to vaporize or atomize the complex molecules without destroying the molecules, release the metal cluster complex into a gas phase, ionize it, and thereby form a beam of the thus-ionized cluster molecule.

According to the inventions recited in amended claims 1 and 11, ***a metal cluster complex*** thus-generated in the gas phase has no distribution of the size thereof. As a result, after ionization, a useful molecular beam of the metal cluster complex molecule uniform in cluster complex size can be obtained.

Other Information for Consideration

A. It should be noted that in more than 20 years of history in the field of the cluster beam, Applicants are not aware of any example or reference in which a multi-nuclear metal molecule, i.e. a metal cluster complex, is utilized to obtain a molecular beam.

B. The innovation disclosed in the present application and recited in amended claims 1 and 11 has been appreciated and several papers (written after the present application) on generation of a cluster ion and its utilization have been accepted by international academic societies. Furthermore, since the originality and innovation disclosed in the present application and recited in amended claims 1 and 11 has been accepted by international academic societies, Applicants have attended at invitational lectures in international societies.

IV. In view of the above, amended independent claims 1 and 11, as well as dependent claims 3-20, are patentable over the applied prior art references and their allowance is respectfully solicited.

CONCLUSION

In view of the above amendment, Applicant believes the pending application is in condition for allowance.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Edward J. Wise (Reg. No. 34,523) at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37.C.F.R. §§1.16 or 1.14; particularly, extension of time fees.

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Respectfully submitted,

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Attachment: Document 1